

Ferree, Melissa A. (DNREC)

From: Sam Ghezavat <Sam.Ghezavat@bloomenergy.com>
Sent: Friday, November 21, 2014 1:14 PM
To: Ferree, Melissa A. (DNREC)
Subject: RE: Bloom Energy - Information Request Deadline Extension
Attachments: Response to DENREC 10-24-14 letter_Final v2 (2).docx

Dear Melissa Ferree, thank you for the grant of extension. Attached you will find a comprehensive response to DNREC's questions regarding Bloom Energy's spent desulfurization waste. A hard copy has been sent to the address noted within the attached. We hope your and your department find this response satisfactory. Please let me know if there are any additional questions. Thank you

Regards;

Sam Ghezavat, Juris Doctor, CSP,ALCM,ARM,CFPS
Director. Environmental, Safety & Health
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be Safe

Be selfish about your safety! Luck runs out. but safety is good for life

From: Ferree, Melissa A. (DNREC) [<mailto:melissa.ferree@state.de.us>]
Sent: Monday, November 10, 2014 1:10 PM
To: Sam Ghezavat
Subject: Bloom Energy - Information Request Deadline Extension

Sam,

Per your earlier phone call, the deadline for responding to our October 14, 2014 letter will be extended from today until Friday, November 21. If you have any questions, please let me know.

Thanks,
Melissa

Melissa Ferree
Engineer III
DNREC - Division of Waste and Hazardous Substances



November 21, 2014

Sent: FedEx and Email

Melissa A. Ferree

Department of Natural Resources and Environmental Control

Solid and Hazardous Waste Management Section

89 Kings Highway

Dover, DE 19901

Subject: Spent Waste Desulfurization

File: Bloom Energy; File Code 10

Dear Ms. Ferree,

Thank you for granting the extension. As requested in the letter from Ms. Karen G J Anthony, Environmental Program Manager I, dated October 14, 2014, following please find the response to several questions contained in that letter:

1. Description of the feedstock entering the container

Pipeline natural gas goes directly into desulfurization (i.e. gas purification) canisters located in the Bloom Energy's electricity manufacturing servers. Bloom Energy does not treat the gas prior to it entering the canisters, therefore, gas quality and composition are expected to meet all pipeline quality specifications as defined by each of the local and national natural gas utilities. Local natural gas utilities are often required to odorize their natural gas; to do this they may inject a specific blend of sulfur compounds (i.e. Mercaptan) into the pipeline at various points inside their distribution network(s). In addition, natural gas contains several Sulfur compounds as natural ingredients.

2. Media inside the container

Bloom Energy's desulfurization canisters usually contain a variety of sorbent materials such as carbon, metal oxides, Zeolites designed to remove a specific impurity from the natural gas. Bloom Energy's desulfurization canisters/tanks are designed to remove any and all sulfur compounds that may be present in the gas stream.

3. A) Material exiting the container

The composition of the gas leaving the canister is almost identical to what goes in with an exception that the gas on the downstream side of the canister is virtually free of sulfur. The downstream gas may still contain some VOC's and other impurities which were present in the feed gas. The primary objective of Bloom Energy's desulfurization media is to remove all sulfur compounds down to the low parts per billion (ppbV) levels.

B) Materials removed from the container at Waste Generation Site in Texas

The sorbents inside the canister remove sulfur either by adsorbing it into the sorbents' pores or by chemically bonding it to the surface of the sorbent(s). In addition to sulfur, some of the materials inside the canister have the ability to pick up other compounds which may be present in the natural gas – including moisture, siloxanes, VOCs, and metals. Analyticals conducted on the spent desulfurization materials indicate that the material's composition can vary. This is because the desulfurization canisters / tanks can come from any geographic locations in the US. where the

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Natural gas is piped into the canisters / tanks through heavy duty rubber hoses connected via quick disconnect couplers. The canisters / tanks are secured to the Fuel Cell Module (FCM). The desulf material inside the canisters / tanks is contained securely via bolts that are torqued. The canisters / tanks are pressure tested up to 24 psi. The maximum pressure of natural gas feed is about 15 psi.

Desulfurization Canisters/tanks meeting EPA's structural integrity requirements.

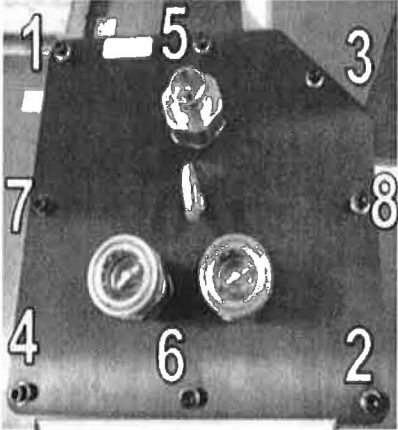
Desulf canisters / tanks are made from extruded aluminum. The wall thickness is 5mm +/- 0.75mm. Below is a picture showing how the bolts are torqued on the top of the canisters.

DESULFURIZER CANISTER FILL


Step 50 Torque Top Lid Bolts

DOC-1003815 REV-A


a. Using a 6mm hex bit and a 33Nm torque wrench, full torque the 8 BOLTS to 33 Nm, following the torque sequence below in picture "A"	All BOLTS are torqued
b. Torque again all BOLTS following sequence in picture "B" notify supervisor if bolt does not tighten	All BOLTS are torqued to 33 Nm ▼




Picture "A" . Torque sequence



Picture "B" . Torque sequence



33 Nm Torque Wrench



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Canister/Tank Removal

The canisters / tanks are periodically removed from the electricity manufacturing servers when the desulfurization materials become saturated and can no longer trap Sulfur. A central Remote Monitoring and Control Center (RMCC) detect a drop in electric generation when this occurs. A field service representative is then dispatched to remove the desulf canister / tank from the FCM and ship it to a central location in Texas for extraction of the desulfurization materials. A typical passage of time from removal of the desulf canister / tank contents is usually 2 weeks. At no time the desulfurization material would exceed the 90 days allowed by EPA before they are removed from the canisters/tanks.

I hope you will find the answers to the questions posed by the DNREC satisfactory and complete at this time. If there are any further questions, please do not hesitate to contact me.

Thank you.

Sincerely,

Sam Ghezavat

Sam Ghezavat, JD, CSP, ALCM, ARM, CFPS

Director, Environmental, Safety & Health
Certified OHSAS18001 Safety Management System
Certified ISO 9001, Quality Management System

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